SEP 8 1941

Gas Journal

LIGHT - HEAT - POWER - BY-PRODUCTS

Vol. 235. 93rd Year. LONDON, AUGUST 13, 1941. Registered as a Newspaper No. 4082. Price 1/-

THE NURSERY SCHOOLS CAMPAIGN IN SCOTLAND.
The assiduous campaigners for Emergency Nursery Centres have now enlisted strong Municipal backing for their scheme which has already had Government support.
The above photograph from the Glasgow "Bulletin" shows the Lord Provost, Sir Patrick Dollan and Lady Pentland at the Ministry of Food demonstration counter which was part of an Exhibition staged at the Glasgow Building Centre recently by the Nursery Schools Association.

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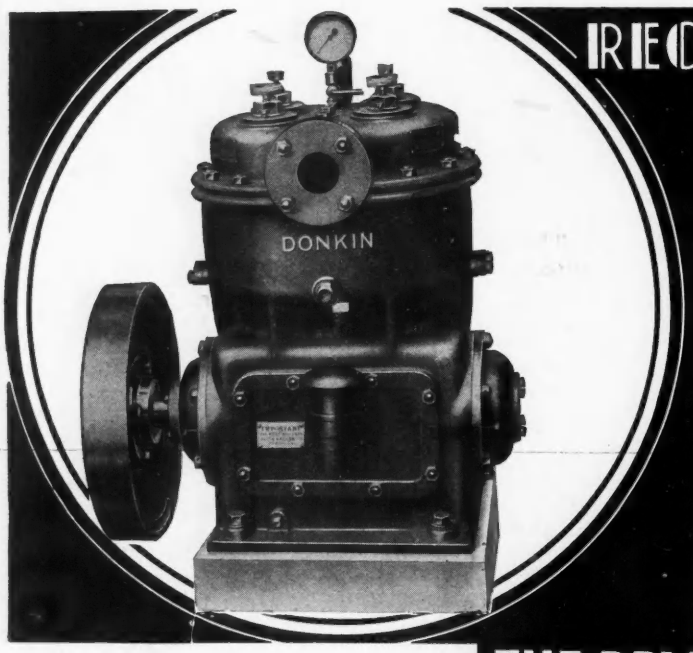

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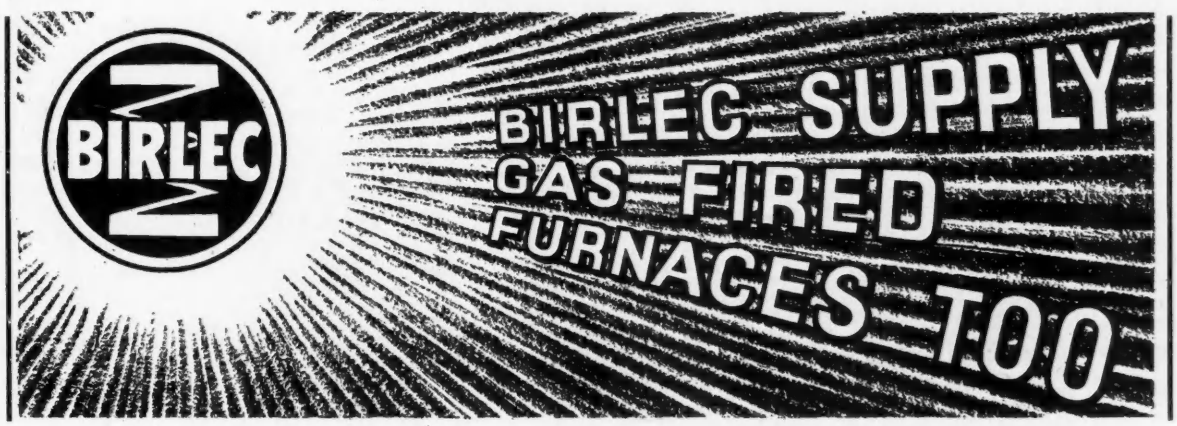

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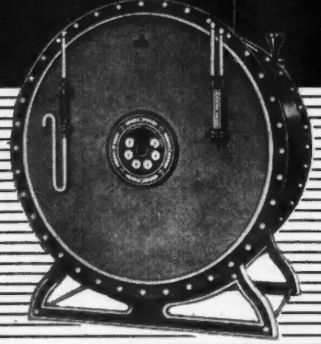

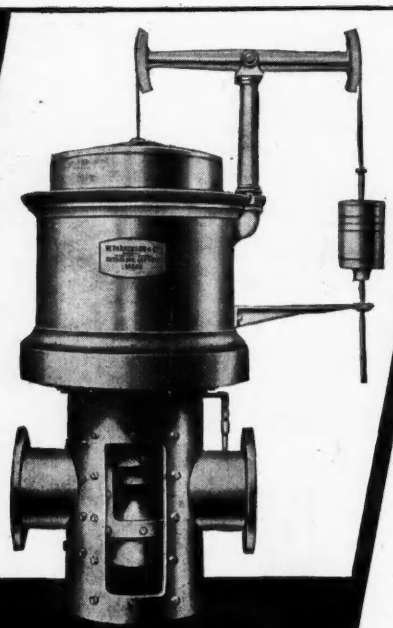

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P.6

GAS JOURNAL, AUGUST 13, 1941

VOL. 235 93rd YEAR No. 4082

EDITORIAL NOTES

THE COAL SITUATION

THE coal situation is not a happy one, and the debate in the House of Commons on Tuesday of last week may to a certain extent have relieved the gloom, but it by no means dissipated it. In brief, the debate was not encouraging—that is, in a general sense. Demand for coal exceeds supply. Far too many skilled miners have been called to the Fighting Services or have been allowed to drift into munition-making employment offering greater financial inducement and less arduous conditions, and no one can deny coal-getting is an arduous and hazardous task. Yet coal must be regarded as a primary munition. Without coal and its products resulting from carbonization and other forms of treatment armaments fade away. It is over three months ago that we referred in these columns to the recommendations of the Select Committee on National Expenditure seeking to improve the distribution and increase the production of coal, but since then migration and conscription have continued the process of converting a labour surplus into a labour scarcity problem in the most important coalfields of the country. Last winter was exceptionally severe, and we were fortunate to "weather" it as well as we did, in face of transport difficulties. Gas undertakings during the past year have been urged by the powers that be to lay in stocks of coal, and we feel we are on safe ground in saying that gas undertakings generally have sought to achieve this object. How undertakings can stock efficiently and adequately with uneven distribution and inadequate production of coal is another matter. We are told that transport conditions are easier now than they were, but we cannot look with complacency to an assured and constant improvement; nor can we contemplate with equanimity the problem of a vastly increased production. Even with its available manpower the coal industry is not yielding more than 90% of its potential capacity. Over 100,000 men have left the coal industry since the outbreak of war; 75,000 have left in the last twelve months. The Government aim at securing 10% more production during the summer months this year. That aim is not being achieved, and more than half of the proposed stocking period has passed.

During the debate in the House one of the Members said that the Government should adopt a much stricter rationing system for gas consumers. The Gas Industry has co-operated with the Government in the past by explaining through many channels to the gas-consuming public how to make the best use of their gas supply in wartime, how, in other words, to effect economies which can be passed on to other consumers more concerned with the use of gaseous fuel in the prosecution of the war. Consumers for more than one reason will do their part by practising the utmost economy with gas. But without adequate coal supplies it is obvious that the Gas Industry cannot manufacture the amount of gas needed for the production of munitions and at the same time ensure the maximum extraction of benzole and toluole which the Government have so earnestly requested and which request the Industry has endeavoured to satisfy. It is discouraging to realize that in some cases benzole extraction plants are lying idle in gas-works because of inadequate coal supplies. In the House on Aug. 5 the Secretary for Mines, speaking of public utilities, expressed the hope that he would soon know that their coal stocks were raised to a more uniform level, which would obviate the risks due to the failure of a small number of public utilities to acquire sufficient coal to replenish the low stocks held last winter. And he also expressed appreciation of the work of the Committee of the Conjoint Conference of Public Utilities, the advice and help of which "had been of great assistance in dealing with the question of coal stocks for public utility undertakings." We know well the good work which the Conjoint Conference has done and continues to perform. The crux of the coal situation is one of increased production and more effective distribution; and the fact should be more fully appreciated that—apart from decline in armament production—public morale would be adversely influenced by failure to supply gas, through shortage of coal, for domestic purposes.

GAS AND COKE

LAST week we commented on the highly successful annual meeting of the London and Counties Coke Association and the equally successful luncheon which preceded it and which was attended by 150 members and guests representing all the affiliated Associations and other bodies with which the Association is in the closest touch. We said that this drawing together of an ever-widening field is a happy augury and that the attendance in wartime of so many busy and prominent men was tribute to the efficiency of a live organization. We are sure that its national importance is destined to increase; we envisage a much greater field for the use of gas coke—and, indeed, all smokeless solid fuels—after the war. We also envisage a much greater field for the use of gas. Time and again we have emphasized that gas and coke are complementary fuels and have pointed to the influence of remunerative coke sales on the price at which gas can be offered for both domestic and industrial purposes. The future ought to and doubtless will see more uniformity in selling policy of both gas and coke. Success depends on the complete breaking-up of the parochial outlook, which has been such a barrier to progress. If the lessons to be learned from the June meeting of The Institution of Gas Engineers are taken to heart and acted upon the parochial outlook will go.

While throughout we have stressed the importance of coke sales—and it is time to say that until the advent of the L.C.C.A. they were sadly neglected—we have given what encouragement we could give in our columns to the investigation on the complete gasification of coal which has now been in progress for some years at Leeds University and the results of which show such great promise. And we were extremely interested in the remarks of Mr. E. V. Evans at the L.C.C.A. luncheon, who is Chairman of the Gas Research Board, which, among other matters, controls the research work at Leeds on the complete gasification of coal. Mr. Evans is also a member of the Executive of the L.C.C.A. Now it might seem, he said, that the work at Leeds aims at the complete abolition of coke as a by-product of the gas-making process; but he went on to assure those present that this is certainly not the case and—what is more—that if this process of complete gasification under pressure ever becomes a practical success (which we sincerely hope it will become) it will strengthen rather than weaken the coke position. He rightly pointed out that by the careful application of a voluntary two-part tariff throughout the country there is scope for a much higher gas consumption per individual consumer than is at present demanded. Experience has shown that the consumer who adopts this voluntary tariff quickly demands more gas. The South Metropolitan Gas Company, for example, found that with such consumers an increase of 25% was achieved in the first year. Now if every domestic consumer in the country took only 10 therms a year more, which on the tariff basis would increase his gas bill 3s. or 4s. annually—an infinitesimal amount—it would throw on to the market as much as 600,000 tons of coke. And it cannot be imagined that the Gas Industry will be satisfied with an additional 10 therms per consumer.

It is a fact that many consumers have trebled and quadrupled their requirements of gas as the result of additional facilities provided by the Industry, and we agree with Mr. Evans that our Industry should aim at at least doubling the present consumption of each individual consumer. This would represent an additional 6 million tons of coke annually. Hence, said Mr. Evans, the necessity of at least exploring the possibilities of complete gasification. He added that the process is still very far indeed from being a practical one, but it is designed to deal with additional gas business and to regulate the quantity of coke made so that the coke available shall be placed on the most suitable and most remunerative market.

POOLED RESOURCES

WHEN in the "JOURNAL" of July 30 we discussed the future of industrial gas in the light of Mr. Hems' Institution Paper, behind our thoughts of the future was the pooling of resources—without which we cannot look forward to success. The war, as was inevitable, has brought about a flux of activity, rural and industrial, and from both the agricultural and the industrial loads much imagination and much skill will be required. New dispositions of industry have imposed many problems on comparatively small undertakings and movement of the population has affected large and small alike. Without mutual assistance and common purpose the Industry would not have made such a good showing, but it is obvious that much remains to be done in many directions, some of the most important forming the subjects of the Papers at the Institution meeting. Last week we published the replies of the Authors to the vigorous discussion, and in point of fact the Authors had little to which to reply, such was the expression of agreement with the ideas put forward. The meeting, as we said at the time, was a call to action, and we know that since that successful and earnest gathering moves have been made in the attempt to bring about a far greater uniformity of policy and practice.

While we are thinking of pooled resources, we might add that shorter contributions to the Press on a variety of subjects would undoubtedly help. That was one of the lessons to be learned from the meeting, the success of which was largely due to condensation of contributions into few words. Lengthy contributions, as we have on more than one occasion pointed out, constituted a matter of concern to us in the palmiest peacetime days. It is obvious that very severe paper restrictions in wartime have necessitated a return to the subject, and the plea for the abolition of verbosity.

Personal

Mr. R. J. PHILP has been appointed Chairman of Duns Gaslight Company for the ensuing term.

* * *

Mr. J. G. POPE, Assoc.M.Inst. Gas E., the Assistant Gas Engineer and Manager to the Workington Corporation, has been appointed to succeed Mr. Hedley Hoy when he retires from the position of Gas Engineer and Manager on Oct. 31. Mr. Pope received his training with the Altrincham Gas Company and was appointed Technical Assistant to the Workington Gas Department in 1928, later being appointed Assistant Gas Engineer and Manager.

1941 "Journal" Directory

The following changes should be noted in order to keep the Directory up-to-date:—

Page 10. BOURNEMOUTH. J. T. Haynes, E. & G.M., *vice* P. G. G. Moon, retired.
,, 16. CHESHAM. R. S. Falkner, E. & M., *vice* F. J. Robinson.
,, 28. GAS LIGHT AND COKE COMPANY. J. S. Thorman, Deputy Chief Engineer ; E. G. Stewart, Station E. Fulham, *vice* J. S. Thorman.
,, 36. ILFRACOMBE. F. J. Robinson, G.M. & S., *vice* R. S. Falkner; R. F. Robinson, E.
,, 38. KIRKBY-IN-ASHFIELD. G. M. Gribble, E., M. & S., deceased.
,, 44. MAIDSTONE. W. A. Howie (Gravesend), E. & M.
,, 50. NEWCASTLE-UPON-TYNE. Redheugh: G. E. Anderson, *vice* N. Reid, retired ; Howden: J. McManus, *vice* G. E. Anderson.
,, 86. GOREBRIDGE. T. Haxton, M.

The Gas Research Board

We have received the following official communication from the Gas Research Board: The basis of co-operative research in the Gas Industry has recently been broadened and extended by the formation, on the recommendation of the Council of The Institution of Gas Engineers and of the Society of British Gas Industries, of an autonomous Gas Research Board. This Body has now received from the Registrar of Companies its official Certificate of Incorporation under the Companies Act, 1929, and has thereby acquired legal status. Its Council is proceeding immediately with the election of members, in accordance with the Memorandum and Articles of Association.

The Gas Research Board has been functioning for some months past, pending its Incorporation, and the Council of The Institution of Gas Engineers has entrusted to the Council of the Board the direction and control of the research work that had previously been pursued by the Institution through its Research Executive Committee. The first Annual Report of the Council of the Board, published in November, 1940, sets out briefly the constitution, policy, and programme of the Board, and gives an account of the investigations at present being carried out for it by its research staff (the former research staff of the Institution) at Leeds University, by the British Refractories Research Association, the National Physical Laboratory, and elsewhere.

The Council of the Gas Research Board comprises nine members appointed by The Institution of Gas Engineers, six members appointed by the Society of British Gas Industries, and up to five co-opted members (University professors, scientists, and the like). If the Board is at any time in receipt of a grant from the Government the Department of Scientific and Industrial Research will be entitled to appoint two representatives to serve on the Council.

The registered offices of the Gas Research Board are the same as those of The Institution of Gas Engineers (1, Grosvenor Place, London, S.W. 1), and the Secretary of the Institution has been appointed the first Secretary and Acting Director of Research of the Board.

The formation of the Gas Research Board arose primarily from the desirability of closer collaboration in research between the supply side of the Gas Industry and the manufacturers of plant and appliances, and in order that, when the time was considered appropriate, financial assistance for such collaborative research might be sought from the Department of Scientific and Industrial Research. Its current investigations are of great potential importance not only in their direct application to gas-making technique, but also as closely affecting future design of plant and appliances. It is intended that all members of the Board shall receive from time to time confidential reports of the progress of its investigations and they will be able, in addition, to suggest to the Council new lines of research and to avail themselves of the facilities afforded by the Board with regard to technical enquiries.

Among the objects of the Gas Research Board are the promotion and support of research in connexion with the Gas Industry and industries allied therewith (and for this purpose to establish and maintain, if and when thought fit, laboratories and the like), to collaborate with kindred research organizations, to publish reports, to collect relevant information, and to establish and maintain for the benefit of its members a Bureau of Information.

For the purposes of the Articles of Association the Gas Industry is defined as (*a*) the manufacture or distribution of gas, or (*b*) the design or construction of works, machinery, plant, or apparatus for the manufacture, distribution or use of gas, or of the by-products of the manufacture of gas, or (*c*) the manufacture or working-up of by-products by undertakings manufacturing or distributing gas, or (*d*) research work connected with the manufacture, distribution or application of gas or of the by-products of the manufacture of gas. It thus embraces all the carbonizing and gasification industries.

The membership of the Gas Research Board consists of Ordinary Members, comprising British subjects and British Corporations carrying on business or otherwise engaged in the Gas Industry, and Associate Members, comprising, with certain restrictions, members of any class of The Institution of Gas Engineers or other scientific workers or persons engaged in or connected with the Gas Industry or likely to assist in its development. The Council may also admit to the Gas Research Board Delegate Members and Honorary Members.

Forms of Application for membership of the Gas Research Board, copies of the Memorandum and Articles of Association, and any other information relating thereto, can be obtained upon application to the Secretary of the Gas Research Board, 1, Grosvenor Place, London, S.W. 1.

The Directors of the Stirling Gaslight Company at the ordinary general meeting recommended payment of a final dividend on the original capital of 9s. 2¾d. per share, less tax, and on the new ordinary capital of 10s. 9d. per share, less tax.

At the Annual Meeting of shareholders of Alyth Gas Light Company, Ltd., presided over by Mr. W. Ritchie Smith, the balance sheet and report were approved and a dividend of 5%, less tax, was declared.

At the Annual Meeting of shareholders of the Hawick Gas Company, Ltd., the Directors reported that, in spite of higher prices for present coal contracts, it had been possible through increased turnover and economies to reduce the price of gas by 1¼d. per 1000 cu.ft. after the August survey.

The Annual General Meeting of the North British Association of Gas Managers will be held in the North British Station Hotel, Edinburgh, on Friday, Sept. 5, when, in addition to formal business, a William Young Memorial Lecture will be delivered by Mr. Dean Chandler, of the South Metropolitan Gas Company.

INSTITUTION OF GAS ENGINEERS

Results of 1941 Examinations

THE undermentioned Candidates were successful in the 1941 Examinations in Gas Engineering (Manufacture), Gas Engineering (Supply) and Gas Supply.

EXTERNAL CANDIDATES (39)

Diploma in Gas Engineering (Manufacture) (6)

Class.	Name.	Town.	Subject of Thesis.
First	Stewart, W. A. M.	Maryport	"Building and Working of a Concentrated Liquor Plant."
,,	Taylor, J. R.	Gillingham	"The Effects of Benzole Recovery and Desulphurization at a Works making Coal Gas in Vertical Retorts and Carburetted Water Gas."
,,	Wright, L. S.	Newcastle	"The Preparation, Storage and Handling of Road Tars to Ministry of Transport Specifications."
Second	Henderson, N.	Eccles	"The Design and Use of Belt Conveyors and Elevators for Gas Works Materials."
,,	King, F. H.	Keighley	"Modifications Carried out on a Three Million Works to Ensure Continuity of Manufacture and Supply under Air Raid Conditions."
,,	Mitchell, W. P.	Motherwell	"The Design and Layout of a New Gas Works."

Higher Grade Certificate in Gas Engineering (Manufacture) (7)

Class.	Name.	Town.
First	Whitestone, P. D.	London
Second	Ellis, F. C.	Torquay
,,	Hill, R.	Kendal
,,	Messenger, E. I.	Workington
,,	Robertson, R. W.	Penrith
,,	Seager, A. C.	Southend-on-Sea
,,	Worters, P. A.	Ulcombe

Ordinary Grade Certificate in Gas Engineering (Manufacture) (4)

Class.	Name.	Town.
Second	Arnold, R. C.	Loughborough
,,	Carpenter, T.	Hereford
,,	Collins, L. J.	Luton
,,	Fielding, F. E.	Selsdon

Ordinary Grade (Single Subject) Examination in Gas Engineering (Manufacture) to qualify to sit for the Diploma Examination in Gas Engineering (Supply) (1)

Class.	Name.	Town.
First	Halliwell, F. B.	Keighley

Diploma in Gas Engineering (Supply) (1)

Class.	Name.	Town.	Subject of Thesis.
First	Tomes, J. A.	Stourbridge	"Pressure Control in Outlying Districts."

Higher Grade Certificate in Gas Engineering (Supply) (6)

Class.	Name.	Town.
First	Ashworth, S.	Darwen
,,	Hooper, K. D.	West Hagley
Second	Foot, J. A. A.	London
,,	Hudson, K. W.	Preston
,,	Mottram, W.	Morecambe
,,	Pringle, T. G.	Edinburgh

Certificate in Gas Supply (1)

Class.	Name.	Town.
First	Nicholson, T. A.	Weston-super-Mare

Ordinary Grade Certificate in Gas Engineering (Supply) (10)

Class.	Name.	Town.
First	Britton, J. C.	Hinckley
,,	*Foster, T.	Lancaster
,,	Godley, J. F. A.	Brighton
,,	Hoskin, J.	Southampton
,,	*Winslow, D. G.	Kenton
Second	Addison, A. G.	Birmingham
,,	Crossley, H.	Elland
,,	Kinsey, R.	Keighley
,,	Payne, E. K.	Reading
,,	Talbot, T. H.	Tipton

Ordinary Grade (Single Subject) Examination in Gas Engineering (Supply) to qualify to sit for the Diploma Examination in Gas Engineering (Manufacture) (3)

Class.	Name.	Town.
First	*Barker, F. C.	Ilkley
,,	Marriage, E. B. R.	Derby
,,	Shortland, G.	Sunderland

INTERNAL CANDIDATES (49)

Higher Grade Certificate in Gas Engineering (Manufacture) (17)

Class.	Name.	Centre.
First	Beavis, D.	Glasgow
,,	Cole, A.	Bradford
,,	Gray, L.	Manchester
Second	Aspden, C. R.	Burnley
,,	Belton, J. F.	Manchester
,,	Campbell, C. A.	Glasgow
,,	Dow, D. C.	,,
,,	Harrison, B. H.	Leicester
,,	Ibberson, V. J.	Sheffield
,,	Kendrick, J. F.	Manchester
,,	Laycock, K. E.	Bradford
,,	McFadyen, A.	Glasgow
,,	Marshall, J. C.	,,
,,	Scattergood, W. H.	Sheffield
,,	Steels, K. D.	Manchester
,,	Taylor, J. A.	,,
,,	Wilkinson, R.	,,

Ordinary Grade Certificate in Gas Engineering (Manufacture) (21)

Class.	Name.	Centre.
First	*Brown, W.	Kirkcaldy
,,	Ridley, N.	Newcastle-upon-Tyne
Second	Aitken, E. J.	Dundee
,,	Baines, R. A.	Burnley
,,	Beale, E. W.	Liverpool
,,	Bowman, N. R.	Manchester
,,	Buckley, F. C.	,,
,,	Chrispin, W.	Burnley
,,	Ferguson, D.	Liverpool
,,	Hood, J. C. F.	,,
,,	Jewell, K. J.	Plymouth
,,	Keay, A.	Dundee
,,	Kehoe, E. F.	Manchester
,,	Kerr, F. B.	Glasgow
,,	Kidd, N. D.	Halifax
,,	Mitchell, A. R.	Newcastle-upon-Tyne
,,	Mitchell, J. V.	Halifax
,,	Nosworthy, S. E. J.	Plymouth
,,	Swinnerton, F. W.	Liverpool
,,	Walker, J. M.	Dundee
,,	Woodcock, J.	Burnley

Higher Grade Certificate in Gas Engineering (Supply) (3)

Class.	Name.	Centre.
Second	Hardie, E. R.	Newcastle-upon-Tyne
,,	Livett, A. E.	Westminster
,,	Waite, N. T.	,,

Ordinary Grade Certificate in Gas Engineering (Supply) (8)

Class.	Name.	Centre.
First	*Badcock, Miss A. C.	Westminster
,,	*Brown, W.	Kirkcaldy
,,	King, J. G.	Westminster
,,	Maw, F. H.	Huddersfield
Second	Anderegg, E. T.	Westminster
,,	Mitchell, W. D.	Leeds
,,	Rowley, F. J.	Huddersfield
,,	Ward, J.	Manchester

1940 EXAMINATION RESULTS

The following additional External Certificates have now been awarded as a result of the 1940 Examinations.

Ordinary Grade Gas Engineering (Manufacture) (1)

Class.	Name.	Town.
Second	Turner, D. J.	Cheltenham

Higher Grade Gas Engineering (Supply) (1)

Class.	Name.	Town.
Second	Armitage, S.	Bristol

* An asterisk against a candidate's name indicates that he has passed with distinction.

1941 REPORT OF THE BOARD OF EXAMINERS

The Board of Examiners has pleasure in submitting to the Gas Education Committee, for presentation to the Council of The Institution of Gas Engineers, its Report on the 1941 Examinations held under the Education Regulations of the Institution.

During the year 1940-41, the members of the Board of Examiners and Assessors, appointed by the Council were:—

Major Courses:

Examiners: E. Crowther, M.Eng., Assoc.M.Inst.C.E. (Newcastle-upon-Tyne), Chairman; G. Dougill, M.Sc., A.I.C. (London); L. P. Ingram, M.Sc., A.I.C. (Loughborough); G. H. Kenyon, M.Sc.Tech. (London); A. Marsden, M.Sc. (Bristol); A. McDonald, B.Sc., A.R.T.C., A.I.C. (Castleford); T. F. E. Rhead, M.Sc. (Birmingham); H. H. Thomas, M.Sc. (Liverpool)—Gas Engineering (Manufacture). J. H. Dyde, M.Sc. (London); J. A. Gould, M.C. (London); H. R. Hems (Birmingham); E. L. Oughton (London); A. C. Rea, M.I.Mech.E. (Bath); W. N. Smirles, B.Sc. (Birmingham); W. K. Tate, M.A.

(London); J. E. White (Newcastle-upon-Tyne)—Gas Engineering (Supply).

Assessors: Gas Engineering (Manufacture) and (Supply). West of Scotland: David Fulton (Helensburgh) and A. S. Nisbet (Paisley). East of Scotland: D. D. Melvin (Edinburgh) and J. W. Napier, M.B.E. (Alloa).

Minor Course and Gas Fitting Courses:

Examiners: E. F. Keable (Great Yarmouth)—Gas Supply Practice; R. N. Le Fevre (London), A. G. R. Kennet (Margate) and J. Robertson (London)—Gas Fitting; A. Marsden, M.Sc. (Bristol)—Elementary Science.

Obituary

It is with deep regret that the Board of Examiners has to report the death on 1st March, 1941, of Mr. E. L. Oughton, a member of the Gas Engineering (Supply) Panel. Mr. Oughton had rendered invaluable service both as a teacher and examiner to the Education Scheme of The Institution of Gas Engineers, which has sustained great loss in his passing.

Examinations, 1941

The more detailed observations of the Board of Examiners on the different Question Papers are set forth below. The Board, however, regrets to find that the standard of the candidates generally was rather lower than in previous years. This is, no doubt, partly accounted for by the difficulties of study under war-time conditions and the smaller total number of candidates entering for the examinations provides a smaller "sample" on which to compare the results. On the other hand, it must be emphasized that the questions set were essentially practical, and the examiners desire to draw the attention of engineers and instructors to the need of pointing out to candidates the importance of giving sufficient attention to detail during their practical experience on the Works and District.

Ordinary Grade Gas Engineering (Manufacture)

Sixty-three candidates entered for the examination, 26 external and 37 internal, as compared with 47 entries received in 1940 with 24 external entries and 23 internal entries. Of the external candidates only 12 satisfied the examiners, but the results of two overseas candidates have not yet been received. Of the 12 who passed, 2, or 7·7 per cent, secured a first class pass as compared with 6·6 per cent who obtained a first class pass last year. On the other hand, 12, or 46 per cent, failed to satisfy the examiners. 23 of the internal candidates passed the examination, but only 2, or 5·3 per cent, obtained a first class pass, one of whom obtained a distinction. 21, or 52 per cent, obtained a second class pass, and 14, or 38 per cent, failed.

On the whole the standard attained was poor, although this may be accounted for partly by the prevailing conditions and the difficulty of young students concentrating on their work. But even allowing for war-time difficulties, the paper was such that a normally intelligent student should have been able to pass after three years' practical experience at a Gas Works.

The composition, expressions and description were not good. The majority of candidates did not even take the trouble to use the squared paper provided for their sketches. The examiners are of opinion that engineers and their staffs are giving insufficient opportunity for instruction to their pupils and apprentices and/or the latter are not sufficiently observant of detail.

It appears that many junior students either do not keep, or are not advised to keep, a diary and make notes and sketches of the practical work which they have to undertake each day.

Higher Grade Gas Engineering (Manufacture)

Thirty-four candidates entered for the examination as compared with 57 entries received in 1940.

Eleven of the candidates were external and 23 internal, compared with 22 entries received from external candidates last year and 35 from internal. 18 per cent of the external students obtained a first class pass compared with 37 per cent last year; 45 per cent obtained a second class pass compared with 46 per cent last year, but 4 candidates, 36 per cent, failed to satisfy the examiners, compared with 1, or 4 per cent, who failed last year.

Of the internal candidates, 6, or 26 per cent, obtained a first class pass compared with 6 per cent last year, 12, or 52 per cent, obtained a second class pass compared with 72 per cent last year, and 5, or 22 per cent, failed, compared with 7, or 20 per cent, last year.

From these percentage figures it can be seen that the standard of the external candidates was rather lower than that of last year. The standard of the internal candidates on the other hand was a little higher, but again the number of failures was about the same.

On the whole the candidates did rather better on the first paper than on the second. Few of the candidates had a thorough knowledge of coke screening plant, or of preparing a water-sealed holder for internal examination.

There was a lamentable lack of knowledge of steam generation, and very few of the candidates attempted the question.

The question on meter testing was attempted by very few candidates. The answers were not very good, and the importance of meter accuracy was not sufficiently realized.

Diploma Grade Gas Engineering (Manufacture)

Eight candidates entered for the examination, of whom 2 secured first class passes, 4 secured second class passes, and 2 failed.

The answers were on the whole rather below average.

In normal times more might have been expected of the candidates, particularly in the direction of critical appreciation of current practice and problems.

The personality of the candidates failed to be reflected in the papers, and the temptation to generalize in answering specific questions should be better resisted.

Ordinary Grade Gas Engineering (Supply)

Thirty-two candidates entered for the examination, compared with 91 entries received last year.

Of these, 5 obtained Distinction, 11 obtained a first class pass, 11 obtained a second class pass, and 5 failed.

On the whole the paper was well answered, as shown by the fact that 16 candidates obtained over 70 per cent.

The correct definition of Graham's Law was known by few candidates. The question on meters was attempted by only 22 per cent of the candidates, and the answers were generally poor. Most of the candidates did not appreciate the question of speed in small high-capacity meters. It was regrettable to find that, although the question on cookers was attempted by nearly all the candidates, the answers were poor, and in many cases the sketches were worse.

The answers to practical questions revealed a lack of actual experience.

Some candidates lost marks on the questions involving calculations through giving the answers in the wrong form.

This is the first year in which both internal and external students have taken the same question paper. Although the numbers entering were rather small—only 20 internal candidates and 12 external—it is interesting to find that the percentage results obtained by the two groups are almost identical.

Higher Grade Gas Engineering (Supply)

Only 12 candidates entered for the Examination compared with 49 entries received in 1940. The results indicate that answers were rather below average. Two candidates obtained a first class pass, 6 a second class, and 4 failed.

It was disappointing to find that the questions dealing with supply on the district were not well answered; a number of the candidates did not appear to grasp the significance of the data given. Only 30 per cent of the candidates attempted the question on gas fires, and the answers were rather poor. Although two-thirds of the candidates attempted the question on gas engines, most of the answers showed a lack of technical knowledge; on the other hand, the same number of students gave good answers on the refrigerating unit.

Again this year the question on factory lighting was poorly done. While some allowance must be made for lack of facilities available for study during the past year, the examiners desire to point out the importance of adequate training in gas lighting engineering.

Certificate in Gas Supply

One candidate entered for the examination for the Certificate in Gas Supply and obtained a first class pass.

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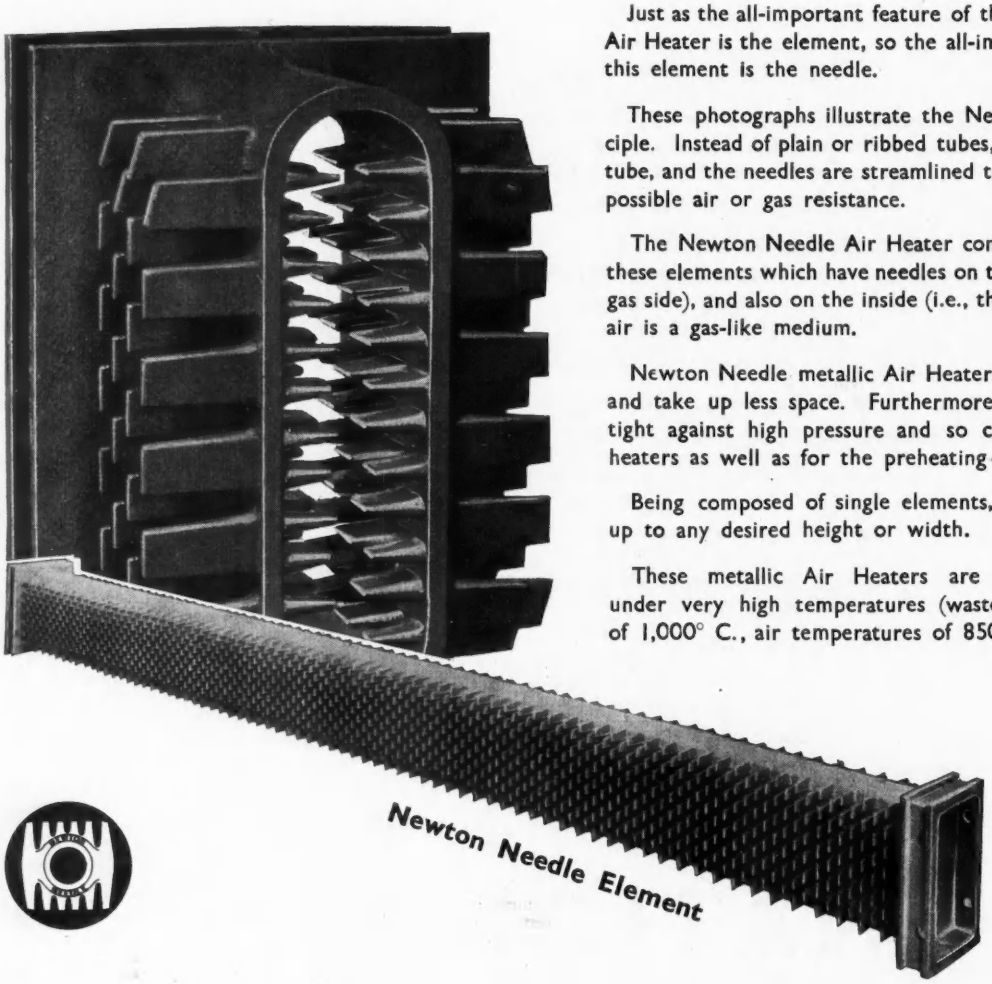

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Diploma Grade Gas Engineering (Supply)

The questions did not appear to have been read as carefully as they might have been and, as a consequence, irrelevant information was introduced into the answer in some cases, whereas in others the vital information was not referred to.

Minor Course Examinations in Gas Supply Practice and Gas Fitting

The detailed reports of the examiners of the City and Guilds of London Institute in Gas Supply Practice and Gas Fitting are not yet available, but the following figures show the number of candidates who entered and passed:

Gas Supply Practice: 5 candidates entered—1 first class, 3 second class, 1 failed.

Gas Fitting, Grade I: 218 candidates entered—163 passed, 55 failed.

Grade II: 146 candidates entered—54 first class, 45 second class, 47 failed.

Final Grade: 117 candidates entered—36 first class, 49 second class, 32 failed.

WAVERLEY ASSOCIATION OF GAS MANAGERS

Discussion on Presidential Address of Wm. C. Campbell, which appeared in our issue of July 23, on p. 135.

Mr. **D. D. Melvin** (Granton, Edinburgh) said he wished to thank the members for again electing him to the Committee. He would do everything he could to further the interests of the Association. The Waverley Association was unique in permitting discussion on the Presidential Address and, in addition to complimenting the President on its preparation, they had the liberty of calling in question any of his facts and opinions. The Address showed he had studied each item of plant on the works and effected economies in each to the overall improvement of works efficiency and more especially a lessening of working costs.

The list of instruments detailed showed that the works were excellently equipped for efficient working and the equipment was even better than that used in some very much larger works. He noticed, however, that there were no fewer than five calorimeters but, when they scrutinized the make per ton and working results they looked in vain for a single calorific value or thermal output figure. The only reference to the point was a passing one on where it was stated—"It is obvious that the calorific value of the gas rose above that normally applied."

With an increase in throughput per retort of about 40% over a period of two years and a decrease in make per ton, one would expect a considerable increase in calorific value notwithstanding the introduction of a benzole recovery plant provided that the coals were of similar quality, but the calorific value had been reduced to 420 B.Th.U. during the past year.

The improvement made in the coke for sale figure was reflected in the balance-sheet. The figure of 9.35 cwt. per ton was surprisingly high for gas of 420 C.V. and he presumed this figure excluded breeze and producer fuel. It would be useful to know the yield of breeze in cwt. per ton and the minimum size of coke sold, as it would appear from the figures quoted that the overall efficiency of the works must be exceptionally high.

In his opening remarks Mr. Campbell stressed the need for constant overhaul and scrutiny of A.R.P. arrangements and he would underline his words. If they were to maintain their service to the consumer and assist in maintaining the morale of the community they must be prepared to restore supplies which had been damaged as a result of enemy action within as short a period as possible. This could only be done by mutual assistance.

In the South Eastern Civil Defence Area he estimated there were 1,100 miles of distribution mains. It was difficult to assess what might be required in the way of stocks, although a formula had been laid down, and he would urge all undertakings to add to their stocks as opportunity presented itself. Some undertakings had a fine and varied stock, but in others there was room for improvement. Labour and particularly skilled labour was needed in the damaged area immediately after a blitz to relieve the stricken undertaking and help to restore normal working. They all had their labour troubles, but he felt sure that if the call went out each and all would assist even at temporary local inconvenience and even if the assistance could only be given for a short time.

Mr. **Robert Cowie,** junior (Hawick), said the Address was of special interest to himself as Galashiels and Hawick were neighbouring towns where the undertakings were of similar size and employed similar plant. Mr. Campbell had obviously put a great deal of work into the Address and it did him great credit. He would like to ask Mr. Campbell if he had had any trouble with air-leaks in the common flue and if this had any bearing on the fact that he had put his two producers to work. They had had the same trouble in Hawick and he would like to see some method of solving this problem. With regard to Mr. Campbell's remarks on the quality of the coke, he was unable to agree that the coke from Lothian coal was poor. They carbonized the same coal in Hawick and found it low in ash, free burning, and easily ignited. He foresaw a great future for this coke in the domestic grate market after the war. In so far as it was small in size it might not be considered ideal for producers. Mr. Campbell's figures regarding saving of coke were so good that he felt there must be some other contributing factor. Did they include breeze? He also felt that Mr. Campbell was expecting too much from the pressure equipment he proposed to install. He would like to have particulars of the meters used for measuring the boiler feed water, as they had trouble in Hawick in using an ordinary water meter for this work. Where were Mr. Campbell's meters installed?

Mr. **T. A. Rowan** (Grangemouth) said that Mr. Campbell had been relentless in his pursuit of efficiency and ruthless in the elimination of waste. He had found fine scope for his energies in the production of solid fuel. His coke figure of 9 cwt. per ton of coal was very satisfactory. He would like to have seen some mention of calorific value when the throughput was as high as six tons per day.

Mr. **R. D. Keillor** (Greenock), President of the North British Association of Gas Managers, complimented Mr. Campbell on his Address and also on the dignity and precision with which he had conducted the affairs of the Waverley Association. He was specially interested in the section dealing with the effect of returns from residuals upon the cost of gas production. In the past five years Mr. Campbell had overtaken a 14% increase in gas production and an increase of 7s. 7.6d. per ton in the price of coal without materially affecting the net cost of gas. It would be interesting to see a comparative statement over the same period based upon a standard make of, say, 130 million cu.ft. per annum as well as with standard prices for residuals. The cost of steam production was stated to be 13.5d. per 1,000 lb. This cost did not appear to include labour and perhaps Mr. Campbell would amplify this point. It might affect comparisons between gas and steam engines for the generation of electricity.

Mr. **R. J. Gavin** (Melrose) said the advice regarding economy in coal was timely when Mr. Bevin and the Minister of Mines were straining every nerve to provide more coal for the nation's use. A saving of 6% would mean a million tons released for other purposes. Of course the contrast between the chemical treatment of coal in a gas works with the release of a multitude of essential wartime by-products and the destruction of fuel in furnaces for the sole provision of heat was brought once more into sharp relief.

Mr. Gavin said he would draw Mr. Campbell's attention to what he regarded as an omission in his otherwise complete record of instruments. He seemed to have forgotten the town pressure gauges at the governor outlet. These were important and might with advantage be of the recording type. Again, the statement on the effect of return from residuals on gas production, while interesting, was rather vague. Mr. Campbell had said that "unless coke commands an exceptional price it is clear that the cheapest gas can be made at the lowest practicable C.V., but when an unlimited demand for coke exists and the net selling value exceeds the price of coal by a certain margin, the reverse is the case." What was this certain margin? The President set a hypothetical case based on standard price of coal 20s. and coke 25s., but that was an excursion into the realms of a gas manager's Utopia which would be difficult of realization in peacetime even with 100% membership of the new Coke Association—which they had not yet achieved. Perhaps the President attached undue importance to increased throughput and had not taken sufficient credit for the undoubted improvements in producer operation, because his analysis showed that in the years 1937 and 1938 he had been able to increase substantially his coke sales figure without increasing throughput.

Mr. **J. M. Dow** (Kirkcaldy) said there was one item which perplexed him, and that was the net cost of gas per 1,000 cu.ft. Had no account been taken of the wages of stokers, purification costs, and so forth? The figure quoted was very much to the low side. He liked the President's treatise on the generation of power in small works. Electricity in a small works took some handling and personally he much preferred steam. Electrical gear had to be supervised and if someone shut off the wrong valve it meant trouble. He hoped Mr. Campbell would meet with success in using his exhaust steam in connexion with the benzole plant.

Mr. **W. Kirk** (Motherwell) said he would like to know how the coal was blended at Galashiels. In connexion with producers he also had trouble at Motherwell when he had two working and one standing idle. The trouble was caused by airleaks, but it disappeared when he put the third producer into operation. He did not think Mr. Campbell had proved his point that an increase in coke was better than one in gaseous fuel. His views regarding the cost of steam were the same as those expressed by Mr. Keillor.

Mr. **E. R. Firth** (Berwick-on-Tweed) said Mr. Campbell's Address was full of knowledge but open to certain criticism. Their President was fortunate in having men at Galashiels who seemed to take an interest in the works. That was not always the case in a small undertaking. Probably Mr. Campbell had trained them to take an interest. He had the necessary instruments, but no meter on the condensers and no thermometer on the purifiers. Money was certainly being saved on coke, but it was done by using the best coke and selling the worst to the consumer. When the present war situation was over would Mr. Campbell still be able to sell that coke? There was a certain margin when coke could not be made at the expense of gas, but Mr.

Campbell had not indicated the margin precisely. Nor had he mentioned labour costs. He said that no allowance for increased handling or wear and tear on plant had been made and that the effect of this on net cost would be slight. He did not agree that the effect would be slight. Mr. Campbell suggested that in view of the by-products made they should get additional supplies of coal. His own view was that they should use as little coal as possible and so ease the strain borne by the railways.

Mr. **David Fulton** (Helensburgh) said that the question of producers was old but ever new. Modern producers looked just like those he saw first of all and in design and construction there had been little change. They were wasteful and unscientific. Nobody ever got the efficiency that a scientific producer would achieve. Not in Galashiels or anywhere else did the men bring out only ashes. With regard to waste-heat boilers, they installed these and so created for themselves the fresh problem of the disposal of fine breeze. There was need for a producer that would burn all breeze from nothing upwards. The present type of breeze-burning was makeshift. They were told that pressure producers would solve the problem, but these, so far as small works were concerned, were still in the experimental stage. Formerly they used the fine breeze to raise steam, but with the disappearance of that outlet it had to go into the producer. They wanted a producer that would burn not only dedusted breeze, but all breeze. It had been in his mind for a long time that research might concern itself with a mechanical producer for all sizes of installations. Those used in large works were very much ahead of those in small works. They gave clean gas, easy control, quicker raising of heat, and fuel consumption proportionate to the coals carbonized. It was a myth to say that a producer used less coke because of its slow consumption.

The merits of coal blending, said Mr. Fulton, were recognized, but it would be interesting to know how it was done in a medium-sized works like Galashiels. How was it done without excessive labour? How was the mixing achieved, and what fuel sizes were employed?

The Author's remarks on increased output per retort gained by increased throughput were interesting. It had been generally accepted that for any retort operating at maximum efficiency the thermal yield on a time basis was constant. It was a pity the comparative tables did not give the calorific values. The view that the use of C.V. was a difficulty could only be described as novel. It was surely fundamental that the "fattest" economic therm was desirable, and the conclusion to be drawn from the Author's experience was that in Galashiels the most economic therm was a bit "fatter" than 420 C.V. It would be of interest to know at what C.V. the therm was cheapest. This was a matter of ultimate importance. The other controlling factor in C.V. determination those days in particular must be economy in coal consumption, and unfortunately this would appear to oppose the cost factor at Galashiels.

The power-steam combination was admirable—it showed imagination—but its value would be better assessed when they had some idea of its working results. The idea of using electric power in a gas-works was good. The totally enclosed motor had a great deal in its favour compared with something exposed to smoke and grit and always needing attention.

Mr. Campbell's Reply

Mr. **Campbell**, replying to the discussion, said that as the Galashiels Undertaking was a non-statutory one they did not require to worry much about calorific value. They tried, however, to maintain the C.V. steadily from day to day. His coke figures applied to coke and not to breeze. At Galashiels they had air-leak trouble even when their second producer was in operation and the leaks had to be stopped. His view was that some of the fuel from the Lothians had not good coking qualities, though perhaps the coal had not been handled too well before reaching the producers. Something has been said about his hypothetical table. He had actually worked out several tables, but had eliminated all but one from his Address. He admitted that all his costs had not been taken into account. On the subject of obtaining extra supplies of coal he still thought that if an extra 13 million cu.ft. of gas were produced, with 20,000 gallons of tar and an extra 800 tons of coke, he was justified in expecting to get the coal. At Galashiels they had the fitments standard in most works. The "certain margin" referred to by some speakers had to be decided by individual gas managers. Their benzole plant had been working for three months and had given them absolutely no trouble. When the pressure producer plant was in he hoped to be able to use small nuts for which they had no sale. The price of the equipment was the worst feature of pressure producers. He would like to let Mr. Frith know they had a meter on the condensers and a thermometer on the purifier. He did not agree that he sold the worst coke and used the best. There had been no complaints from consumers. He was no supporter of thermal values, but believed the gas unit was a better standard.

SULPHATE REDUCING BACTERIA*

By C. A. B. WOODHEAD, A.I.C., *Birkenhead Gas Department*

SULPHATE reducing bacteria can be a nuisance to a gas engineer mainly in two ways: (1) They are capable of causing corrosion and pitting of wrapped iron or steel mains which are laid in good clay; (2) they can generate hydrogen sulphide in water sealed gasholders, often of sufficient concentration to exceed the B.O.T. limit.

(1) *Anaerobic corrosion of mains.*—This note is not concerned with this aspect. I have no personal experience of this yet, although at Birkenhead cases of bad pitting of 10 in. high-pressure wrapped steel mains have been reported, where these mains have been laid in good clay. The symptoms point to bacterial trouble—*i.e.* graphitization and blackening of the clay in the immediate vicinity of the main.

It has been pointed out that cellulose bacteria decompose the hesian wrapping, providing organic acids, and the clay provides sulphates and the other minerals required for the metabolism of the Sulphur bacteria.(1).

(2) *Contamination in gasholders.*—This trouble appears to have commenced in most cases some time after naphthalene removal started. It would seem that holders can remain sterile for years providing the holder tank is not emptied and refilled, nor an excessive make-up is used. On refilling, even with town water, the trouble may become apparent within 2–3 months. The symptoms are, darkening of the holder water at certain periods, and, of course, the appearance of H_2S on the outlet of the holder, the inlet being clean.

Importance of H_2S test.—It is quite probable that at many works the trouble is present, but goes undetected due to—

1. Period of test—24 hours' tests should be made.
2. Gas rate—this should be standardized, preferably at 5 cu.ft./hr. or over.
3. Position of test and connexions—long lengths of main or of iron or copper pipe may reduce or remove traces of H_2S from the gas.

   The test should be connected to the holder crown or outlet leg by as short a length of tubing as possible, preferably glass.

It is very important to get early information of any trouble, so that corrosive influences may be checked and any possibility of exceeding the B.O.T. limit, due to rapid development of the bacteria during spring and summer, prevented.

Nature of the bacteria.—The type of bacteria in which we are interested belongs to the general class of sulphur bacteria(2) which gives rise to a sulphur cycle in nature, similar to the more well known nitrogen cycle.

The aerobic members of the class each oxidize a specific sulphur ion to a certain more highly oxidized ion, in the presence of oxygen. The anaerobic members reduce sulphur ions in specific stages in the absence of oxygen. While many types may be present in holder water, we are only interested in those which reduce sulphates to H_2S, the type member being *Vibrio desulphuricans.*

All bacteria may be classified in three groups:

(1) Bacilli—in the form of rods, developing to form chains.
(2) *Vibrios*—the "S" or "Comma" shaped bacteria forming spirals.
(3) *Cocci*—having a spherical shape and develop by budding.

Vibrio desulphuricans.—These vibrios develop readily in gas-holder water in the absence of any suitable bactericide, as they require anaerobic conditions and only very small concentrations of sulphates, phosphates, and a few other ions for their metabolism. Their carbon content may be supplied by almost any organic acid, as Baars(3) has shown, even by CO_2 in solution.

The sulphates, &c., may be supplied by the water added, rain water, or clay in a clay base holder. They are widespread in nature. H. J. Bunker has examined samples of subsoil from many parts of the world and has found them present in nearly all cases. The mud flats of the upper estuary of the Mersey provide a local example. On the surface they are brown, due to atmospheric and other oxidation of the black iron sulphide beneath the surface, which has been formed by the action of bacteria, reducing sulphates in the sea water.

Dutch micro-biologists were the first to study and isolate these bacteria, and traced odours produced in Dutch canals to sulphuretted hydrogen produced by bacterial action.

Detection and Counting of the Bacteria

The usual method of counting bacteria is to add a known amount of well shaken sample (to break up aggregates) to a selective sterilized medium in melted gelatine or agar-agar. After shaking and allowing to set, the tube is incubated below the melting-point. Each cell should develop into a colony visible to the naked eye, when a count may then be made.

However, apart from the necessity of cultivating the bacteria in anaerobic conditions, the difficulty is that in the case of sulphate-reducing bacteria which are very motile, many of the cells do not develop in a solid medium. Recently, however, some success has been achieved by using a very weak gelatine.

A method of making a count in liquid media has been described by H. T. Rogers (4), using the statistic tables of Halvorsen and Zeigler. For gas-works purposes it is only necessary to know if the particular bacteria are present and whether the contamination is light, medium, or heavy.

At the Athol Street Works of the Liverpool Gas Company a method was adopted which was found to be quite suitable for the purpose, the

(*Continued on p. 255*)

* From a Paper to the Manchester and District Junior Gas Association.

details of which were very kindly supplied by Mr. H. T. Rogers of the British Non-Ferrous Metals Research Association.

Details of Test

Required: An incubator or thermostatic bath (for comparative results). A stock of Van Delden's medium. 2-oz. narrow neck glass-stoppered bottles. Powdered calcium carbonate.

A thermostatic bath is used, fitted with a toluene-gas thermostat, the test bottles resting on a perforated tray so that all but the necks are immersed in water. An electric agitator or a jet of compressed air may be used for stirring the bath.

VAN DELDEN NO. 1 MEDIUM (QUADRUPLE STRENGTH).

K_2HPO_4	... ...	0.25 grm.
Sod. lactate	... ...	2.5 ,,
$MgSO_4$	... ...	1.0 ,,
$FeSO_4$	... ...	0.02 ,,
Tap Water	... ...	250 c.c.

The medium should be sterilized by boiling in a flask fitted with a cottonwool plug, for one minute on each of three successive days, to destroy spores. If the cottonwool plug is removed, re-sterilize. Test bottles and pipettes may be sterilized with conc. HCl and washed with sterile water (or tap water if a blank shows no development).

A pinch of powered $CaCO_3$ is added to the test bottle, to prevent the pH value falling, and also provides a surface for the development of the bacteria (H. T. Rogers).

10 c.c of medium is then added and the bottle completely filled with the contaminated sample, the stopper being added without entraining any air.

The bottle is then placed in the thermostatic bath and incubated at, say, 30°C. If the bacteria are present patches of grey or black spots appear on the $CaCO_3$ (4), developing to black over the whole surface, due to the precipitation of iron sulphide, the $FeSO_4$ in the medium acting as an indicator.

Development in 4 days	... ...	Heavy contamination.
,, 4-12 days	...	Medium ,,
,, 20 days	... ...	Light ,,

Note: Important to exclude air from the sample.

Method of Dealing with Contaminated Holders

Oxidents

(a) *Aeration.*—At Athol Street the circulation of holder water over the crown was tried, and while the gas was certainly much cleaner for a while, the contamination became as bad as ever within about six weeks. Aeration does not kill the bacteria; they recommence their activity when anaerobic conditions are restored. One large undertaking experimented with continuous aeration, but found that the dissolved oxygen caused excessive corrosion.

(b) *Bleaching powder.*—This has been used apparently with some success, but this is also likely to lead to corrosion, and although accurate methods of chlorine control are now available there are other potential objections.

(c) *Chlorination.*—I do not know whether this has been applied to holder water treatment, but it is a very economical method of sterilizing large volumes of water coupled with after treatment to destroy the excess chlorine, as in swimming-baths, &c. The above mentioned potential objections apply to this also.

(d) *Ozone* is coming into prominence for water treatment and should be particularly useful with this type of bacteria. The cost of treatment for other purposes is reported to be very low.

With methods (c) and (d) a good deal of the reagent would be used, in the case of holder water, in oxidizing the H_2S in solution and the FeS at the base of the holder which might amount to several tons; however, initial aeration may render these methods practicable.

Precipitation as Sulphide of H_2S

Many metallic salts may be used to accomplish this, such as: Lead acetate, lead chloride, copper sulphate, cadium chloride, zinc acetate, and ferrous sulphate. However, there are several factors which reduce the choice to narrow limits.

1. If the anion is that of a strong acid, the reaction with H_2S will produce the free acid and so accelerate corrosion—

e.g., PC. $CL_2 + H_2S = PCS\downarrow + 2\,HCl$.

2. If the anion is of a weak organic acid—*e.g.*, zinc acetate, the quantity of acetic acid likely to be formed will have a much smaller effect on the pH value; however, as has been stated previously, such acids provide the bacteria with a valuable portion of their diet.

3. Sulphates should not be used, because the SO_4 is essential to the bacteria for H_2S production.

4. The metallic radical should be electro-negative to iron, otherwise there would be a tendency for iron to go into solution and the metal deposited.

5. Cost may be a deciding factor.

6. The quantity of reagent required to depress the H_2S in the gas to the limits required. This may vary from a few pounds to several tons, depending on the temperature, pH value, and the metal used. This initial amount is independent of the periodical amount which must be added to maintain the desired reduction of H_2S concentration.

Colloidal Zinc Oxide

Bearing in mind the six points outlined above relating to the choice of a precipitant it has been found that the best selection to date is *colloidal* zinc oxide, the use of which has been developed by the South Metropolitan Gas Company and the Gas Light and Coke Company, and manufactured by the former.

In the case of very large holders, water is pumped from the base of the tank to just below the water surface in the centre of the holder. Colloidal zinc oxide in suspension (from a tank fitted with a stirrer) is added at the pump suction and the temperature of the water raised 10°F. above the holder surface water temperature by steam injection.

The warmer water then spreads like a blanket over the surface, allowing the zinc oxide to fall slowly and dissolve throughout the holder tank.

For smaller holders the pump is replaced by a steam ejector and the delivery brought to the surface inside the tank at the suction side.

(*Note.*—A reserve of zinc should be maintained in the water—0.5 g./gall. should prove ample.)

Effect of Iron Sulphide at Base of Holder

Most old gasholder tanks, or tanks which have suffered from bacterial trouble for some time, will have a mud deposit at the base consisting largely of FeS. This FeS may amount to several tons. FeS will dissociate and give H_2S in the gas, the extent depending on temperatures pH, and Fe″ content of the water. As sulphur ions are removed by zinc treatment more FeS will dissociate to reach the solubility product of FeS; thus the ferrous ion concentration in the water will increase with treatment, equilibirum being established when Fe″ concentration (at 25°C.) is 10,000 times that of the zinc.

This ferrous iron is in the form of ferrous bicarbonate which is soluble in water but deposits red hydrate of iron when exposed to air. From this it may be found desirable to add the initial amount of ferrous bicarbonate required and afterwards treat with zinc oxide or ferrous bicarbonate, or to clean out the tank and use zinc oxide.

It must be pointed out that equilibrium conditions at a particular temperature have been considered—*i.e.*, if the holder stood for a sufficiently long time for equilibrium to be established. However, in practice the concentrations will be lower than the calculated figure when the holder is working, depending on the gas rate and the rates of diffusion in gas and water.

Bactericides

As the volume of water in a holder may amount to millions of gallons, even if a bactericide were suitable, its cost may be prohibitive. After a good deal of research, H. T. Rogers(4) has discovered that dyestuffs of the acriflavine and proflavine class are effective at concentrations in the order of 1 pt./million. As most of these dyes are very expensive, he has in conjunction with I.C.I. Ltd. developed a similar dye, named "914," which is equally as effective as acriflavine and about 1/10th the cost at about 30s. per lb.

This has apparently been found very effective in large scale tests on similar problems outside the Gas Industry, and also in tests on small steel tank gasholders. In one case a contaminated 1½ million gallon holder tank was emptied, and refilled with town water containing the dye "914" at 1 pt./750,000. This tank was brick lined with a clay base. At first the yellow colour of the dye was well marked and the water free from bacteria. However, the test paper on the outlet gas still showed medium brown stain in 24 hours, no doubt due to the dissociation of FeS accelerated by the town's water containing a negligible amount of Fe″.

After 4 months the colour had completely disappeared and the bacterial test showed the water to be much more heavily contaminated than hitherto. Probably this was due to some of the bacteria not being killed, and with a fresh source of sulphates in the town water had been able to develop rapidly when the dye had been absorbed by suspended solids and the clay and sludge at the holder base.

The dye works perfectly when added to a test culture of contaminated water at a concentration of 1 pt./mill. (approximately, depending on the contamination), a control showing positive and the dye treated sample remaining negative indefinitely.

When applied to clay-based holders, a greater initial concentration or a second treatment of the dye to the same water may be successful. No doubt when further work has been done or more effective compounds produced this method may be the best solution to the problem.

Work at Athol Street Works

The ideal bactericide would have the following characteristics: (1) Low cost; (2) no corrosive effect on the ironwork; (3) non volatile; (4) not be absorbed and so lost from solution.

An attempt was made to find such a bactericide or one satisfactory in the most important respect (1) and (2).

β naphthol was found partially effective, but the cost to treat a holder would be very much greater than with the dyestuff, although its effect would probably be more permanent.

Naphthalene was found to be very effective; 0.05 g. of naphthalene added to a test on contaminated water will completely suppress bacterial activity. The difficulty with naphthalene is that it is only very slightly soluble in water and very volatile, and while heavier than water it is very difficult to sink; particles on the surface, or carried to the surface, remain there. This latter trouble, it was found, could be avoided in the initial addition by making a suspension of naphthalene in water to which 0.1–0.2% of I.C.I. perminal setting agent had been added. After adding to a bulk of water the naphthalene remained at the bottom, but if brought to the surface by effervescence it remained there.

Naphthalene was also added to contaminated holder water, by passing the water through a bed of naphthalene, which attained a concentration of approximately 5 pts./mill. The naphthalene used was that crystallized from solvent naphtha from a benzole plant, its

(*Continued on p. 258*)

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Gas Products Prices

The London Market

Aug. 11.

Current prices of Tar Products in the London market are today approximately as follows:

Pitch is nominal; creosote 4¾d. to 5d.; refined tar 3¾d. to 4d.; pure toluene under the Ministry of Supply Toluene No. 2 Order 2s. 5d.; pure benzole 1s. 10d.; 95/160 solvent naphtha 2s. 5d. to 2s. 8d., and 90/160 pyridine 13s. 6d.; all per gallon naked; refined crystal naphthalene £23 per ton in bags; all *ex* Makers' Works.

The Provinces

Aug. 11.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 1s. 10d. (controlled by the Control of Toluene No. 2 Order, July 5, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North, 10d. to 11d. Solvent naphtha, naked, North, 1s. 9d. to 1s. 10d. Heavy naphtha North, 1s. 6d. to 1s. 7½d. Creosote, *ex* works, in bulk, North, liquid and salty, 4½d. to 4¾d.; Scotland, 4¼d. to 4¾d.; low gravity, 4½d. to 4¾d. Fuel Grade, 4d. to 4¼d. Carbolic acid, 60's, 3s. 7½d. to 3s. 9d. Naphthalene, £12 to £15. Salts, 70s. to 80s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal. Heavy oil: Unfiltered anthracene oil (min. gr. 1,080), 5¼d. to 5½d.; filtered heavy oil (min. gr. 1,080), 5¾d. to 6d.; heavy anthracene oil gr. less than 1,080, 6d. to 6¼d.

*In regard to pitch and crude tar prices we would ask readers to refer to the editorial note in our issue of Sept. 4, 1940, p. 404.

Tar Products in Scotland

Glasgow, Aug. 9.

Prices are well maintained in this locality, but new business is not too easily arranged because of various restrictions on the use of most distillates.

Refined tar is in good call at 4¾d. to 5d. per gallon for home trade and round 3½d. per gallon for export, both f.o.r. naked.

Creosote oil continues in steady demand with prices firm as follows: Specification oil, 5¾d. to 6d. per gallon; low gravity, 6½d. to 7d. per gallon; neutral oil, 6d. to 6½d. per gallon; all *ex* Works in bulk.

Cresylic acid: Supplies are not too plentiful and prices are firmer as under: Pale, 99/100%, 3s. 6d. to 3s. 9d. per gallon; Pale, 97/99%, 3s. 3d. to 3s. 6d. per gallon; Dark, 97/99%, 2s. 9d. to 3s. per gallon; all *ex* Works in buyers' packages.

Crude naphtha is unchanged at 6½d. to 7½d. per gallon *ex* Works in bulk, according to quality.

Solvent naphtha: 90/160 grade is 1s. 8½d. to 1s. 9d. per gallon and 90/190 Heavy Naphtha is 1s. 4½d. to 1s. 5½d. per gallon.

Pyridines continue without interest with prices nominal at about 14s. per gallon for 90/160 grade and 16s. per gallon for 90/140 grade.

At a Meeting of the Finance Committee, the Directors of the Croydon Gas Company resolved that "in accordance with Sections 7 and 27 of the Croydon Gas Act, 1922, and the Defence (Gas Charges) Orders, 1939 and 1940, dividends for the half-year ended June 30, 1941, be declared and paid on the Sept. 1 next at the following rates per centum per annum, less income tax: Preference Stock, 4; Maximum Dividend Stock, 5; and Sliding Scale Stock, 6."

Gas Stocks and Shares

The stock markets commenced business after the long week-end on a firm note, although the previous rise in equities showed a slower tendency. After Mr. Attlee's review of the war situation, however, a distinctly cheerful tone set in and British Funds quickly responded but later the Chancellor's announcement with regard to National War Bonds 1946–48 and 3% Savings Bonds 1955–65 caused some reaction in this section. There was less business in the industrial section, but prices, helped by a shortage of shares, were inclined to harden. A few improvements took place among oil shares and teas also took on a firmer tone, but rubber shares continued dull and uninteresting.

The previous display of strength in the Gas Market shows no signs of weakening and stocks and shares in this section were again well supported last week, a number recording further improvements. A large turnover took place in Gas Light units and these, together with Croydon sliding scale and Imperial Continental were each marked up 5 points. Inquiries for a number of others, including South Metropolitan 6% preference and Wandsworth consolidated also brought about improvements. The small drop in Eastbourne "B" stock in the Supplementary List was due to a shortening of the margin from 20 points to 5 points.

The following is a full record of the price changes during last week:

OFFICIAL LIST

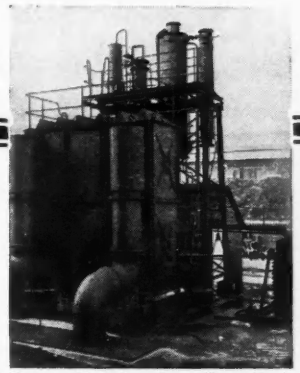
Croydon Sliding Scale	85—90	+5
Gas Light Units	13/9—14/9	+1/-
,, 3½ p.c. max.	42—47	+2
,, 3½ p.c. Red. Pref.	66—71	+4
Imperial Continental	57—62	+5
Mid Southern "C" Cons.	68—73	+1
South-Eastern Gas Corporation Ord.	10/6—12/6	+-/6
,, 4½ p.c. Pref.	14/6—16/6	+-/6
South Metropolitan Ord.	49—54	+1
,, 6 p.c. Pref.	75—80	+3
Wandsworth Cons.	67—72	+3
,, 4 p.c. Pref.	65—70	+2

SUPPLEMENTARY LIST

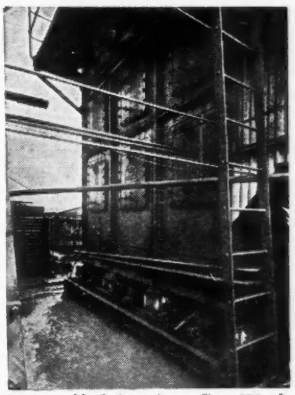
Cambridge "B" (*x.d.*)	100—105	Aug. 5
Eastbourne "B"	35—40	-2½

PROVINCIAL EXCHANGES

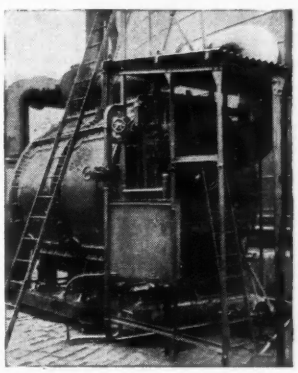
Bath (*x.d.*)	93—97	July 28
Bristol 5 p.c. max.	84—86	+1
Newcastle Units (*x.d.*)	17/3—18/3	July 28
Sheffield Cons.	108—110	+1



"Permac" Joints in a Gas Works.



"Permac" Joints in a Gas Works.



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purity being approximately 96%. This was found to be effective, but after washing the naphthalene bed overnight a further test was a failure. It was suspected that the crude naphthalene contained an impurity which was more effective.

Further tests were carried out, adding a crude and pure naphthalene in alcohol to give concentrations varying from 8–30 pts./mill.; these indicated that the crude naphthalene was more effective than pure naphthalene. It was thought likely that any such compound that exists in the crude naphthalene would be found among the coal tar products; however, while many of these have been eliminated, no effective compound has been found. My work in this connexion was cut short by my appointment at Birkenhead, but I hope that the above notes may prove interesting, and helpful to any who would like to take up the work and provide the Gas Industry with the best solution to the problem of the sulphuretted hydrogen bug.

This problem will be more acute from now on, due to the increase in the practice of benzole washing and also the emptying and refilling of holder tanks after repairs following enemy action.

References

(1) H. J. Bunker, *J.S.C.I.*, 58 . 3 . 93, 1939.
(2) D. Ellis, "The Sulphur Bacteria." H. J. Bunker, "The Sulphur Bacteria," Communication of Dept. of Scientific and Ind. Research.
(3) Baars, *Dissert. Delft*, 1930.
(4) H. T. Rogers, *J.S.C.I.*, Feb., 1940, pp. 34-39.

Discussion

Mr. **H. C. Applebee** (Manchester) said that in his early days it was always a mystery to him why gas which was clean on entering the holder should come out again showing obvious signs of H_2S. Relatively recently the discovery had been made that bacteriological action had been the cause, at least in some cases, though he sometimes wondered whether there were not some other causes which produced H_2S in the holder. Waterless holders were not in favour at the present time, but at least they did not cause this trouble.

Mr. **Albinson** (Manchester) related an experience he had some years ago. There were two holders at a small works, and the water for filling the tanks was taken from a stream which ran near the works and passed over a small pit or dam. Upstream there was a small village and a bleach works. When the tank of the new holder was being filled, arrangements were made whereby the bleach works agreed not to run any effluent into the stream, so that only pure stream water would be used. Trouble was eventually experienced with H_2S in the gas from the new holder and it was found that the stream water was contaminated with crude household sewage from the village. No trouble was experienced with gas from the other holder, but in this case no precautions were taken to prevent the bleach works' effluent flowing into the stream. Samples of water were taken 8 ft. below the surface of the holder, and also from the stream. The water in the holder was just acid, having a pH value of 6.2, whereas the stream water was alkaline. The sulphates in the holder water were negligible, but they were definitely present in the stream water. The H_2S in the holder water actually amounted to 0.12 grains per gallon, but the stream water was perfectly free. Total solids were 9.4 and 11.8 respectively—*i.e.*, approx. 2 grains per gallon less solids in the holder water. This fact appeared to show that bacteria could reduce inorganic solvents. The evolution of H_2S from water was first thought to be due to vegetable matter forming humic acids, which reacted with naturally occurring iron sulphide round a pool or any ordinary marsh gas evolution. Research work has shown that bacteria could reduce ordinary inorganic sulphates.

He recommended treating the holder water with sodium arsenate, which was a good bactericide, and which would also have the effect of precipitating any further H_2S as arsenate sulphide. It was, however, considered inadvisable to use such a poisonous substance, and finally chlorine was used, the water being brought up to 9 to 10 in order to neutralize any acidity that might be produced. When consulting reference works, the reagent he found to be recommended was sodium-ferro-tartrate in the medium, which showed a black stain of ferrous sulphide when sulphur producing bacteria were present. Practically every bacterium present in ordinary household sewage could produce H_2S under favourable conditions.

This Paper had served a particularly useful purpose in pointing out that it was not a matter of indifference what kind of water was used for filling a holder tank. Precautions must be taken to ascertain that it was sterile. Further, care should be taken so as to avoid fine oxide being blown into the cups of the holder, for oxide provided the ideal food for the types of bacteria which could produce H_2S.

Mr. **E. B. Fields** (Blackburn) enquired if oil filming of holders overcame contamination by H_2S. Some years ago trouble was experienced with spotting by H_2S, but after oil filming the holder no further trouble was experienced.

Mr. **Woodhead,** in reply, said that oil filming would not actually kill the bacteria, which would remain active in the water below the oil film, unless a bactericide was also present. Consequently, there would be no prevention of H_2S, because H_2S was very soluble in oil. It could reach a certain concentration in the oil and then pass into the gas. To those interested in methods of killing bacteria, Mr. Woodhead recommended the fitting up of an incubator and cultivation in the Van Delden medium. It would then be a simple matter to experiment with suitable bactericides.

Mr. **Hogg** (Stretford) called attention to the method of drawing gas through a lead acetate paper. He had made a test by this method and found that it was quite possible to obtain quantitative results, a depth of stain being produced on the paper. Oil filming had very little effect in preventing H_2S getting into the gas. The H_2S appeared to conglomerate in the oil and then pass into the gas, passing through the oil in almost equal quantities. In the case mentioned by Mr. Fields the oil might have been of a different composition and contained naphthalene, which had an effect on the surface water.

Mr. **Woodhead** replied that the Gas Light and Coke Company's apparatus had been tried in a test for H_2S, but the concentration varied considerably with the weather. A large volume of H_2S was driven in during warm weather, whereas in cooler weather the bacterial activity was not so pronounced. Further, the concentration of H_2S increased in the water without increasing in the gas, because there was greater solubility in the water. Reliance was placed mainly on comparative tests, passing 5 cu.ft. per hour. Where tests were made indoors, the outlet for the gas was fitted with an orifice floor gauge in order to give a differential of, say, 2 in. per 5 cu.ft. per hour. It was much more important to concentrate on the causes, such as the examination of bacteria, rather than effect, and study the variations in concentration.

A vote of thanks was proposed by Mr. E. Bates (Manchester) and seconded by Mr. E. Fields (Blackburn.)

Control of Factory Premises

As foreshadowed in the "Journal" of May 7 (p. 225), an Order has been issued by the Board of Trade to prevent the uncontrolled use of existing factory and warehouse premises which might be required for essential purposes, and to safeguard as far as possible firms which have moved from one district to another from having their new premises requisitioned shortly after they have entered into occupation.

The Location of Industry (Restriction) Order, 1941, provides that no one may, without a Board of Trade licence, carry on at any factory or warehouse having an area of 3,000 sq.ft. or more any trade or business not carried on there previously; or carry on at other premises with an area of 3,000 sq.ft. or more, whatever their previous use, a business of production or storage. The use of premises of an area of less than 3,000 sq.ft. is not subject to licence, but any number of separate premises within a quarter of a sq. mile are to be treated as being parts of the same premises.

The Order does not apply to shops or to new buildings, and a general licence is being issued providing for the use of premises for temporary storage purposes without a specific licence, but the Board must be informed in writing if any premises are so used. Special consideration will be given to applications by firms dispossessed by enemy action or through other causes outside their control, to use alternative accommodation in the immediate vicinity of their former place of business.

Firms who wish to use premises for production outside their own immediate neighbourhood and who are working for a Government Department or producing raw materials covered by the Ministry of Supply controls, must apply to the appropriate local representative of the Department concerned; in cases of doubt as to the Department or officer concerned, the advice of the Regional Controller of Factory and Storage Premises should be sought. Other firms, firms engaged on production who wish to use alternative premises in their own neighbourhood, and firms who wish to acquire premises for storage, whether in their own neighbourhood or elsewhere, will have to apply to the Regional Controller in the area in which they are carrying on business at the time of the application. Copies of the Order (S. R. & O., 1941, No. 1, 100) are obtainable from the Stationery Office and booksellers, and an explanatory memorandum dealing with the scope and purpose of the Order and the method of applying for licences is available from either the headquarters or regional offices of the Control of Factory and Storage Premises, Board of Trade, or local Chambers of Commerce. A list of the regional offices is obtainable from the headquarters, Millbank, London, S.W. 1.

Coal Supplies in Ulster

The question of imposing a more stringent coal rationing system is being investigated in Northern Ireland in conjunction with coal importing and distributing interests. All Northern Ireland's coal supplies have to be shipped from Great Britain. Much is being done to develop the use of peat as domestic fuel in the rural areas.

Appealing to housewives to reduce the consumption of coal, gas and electricity to the minimum, the Minister of Commerce says: "Although supplies sufficient to meet current consumption needs are coming forward, stocks in reserve are quite inadequate. I appeal to all householders to economize in every possible way in the use of coal, and to endeavour to lay up stocks of wood for winter use, so that industrial establishments and public utility undertakings such as railways, gas-works, and electricity stations may be able to build up more adequate reserves for the coming winter. A householder who has already in stock a minimum of two tons of coal will not be entitled to any further supplies."

The Following Meetings of the London and Counties Coke Association have been arranged for Monday, Aug. 18, at Gas Industry House. Finance Committee, 10.45 a.m.; Executive Committee, 11.15 a.m.; Central Committee, 2.30 p.m.

Associated Gas and Water Undertakings, Ltd., which controls 26 gas and electricity undertakings in Southern England, has acquired a majority share interest in the Steyning and District Waterworks Company, Ltd.